

the date of manufacture of the individual engine was after December 31, 1999 (Tier 2):

Oxides of Nitrogen:  $(32 + 1.6(\text{rPR})) \text{ g/kN rO}$ .

(v) The emission standards prescribed in paragraphs (d)(1)(iii) and (iv) of this section apply as prescribed beginning July 7, 1997.

(vi) The emission standards of this paragraph apply as prescribed after December 18, 2005. For engines of a type or model of which the first individual production model was manufactured after December 31, 2003 (Tier 4):

(A) That have a rated pressure ratio of 30 or less and a maximum rated output greater than 89 kN:

Oxides of Nitrogen:  $(19 + 1.6(\text{rPR})) \text{ g/kN rO}$ .

(B) That have a rated pressure ratio of 30 or less and a maximum rated output greater than 26.7 kN but not greater than 89 kN:

Oxides of Nitrogen:  $(37.572 + 1.6(\text{rPR}) - 0.2087(\text{rO})) \text{ g/kN rO}$ .

(C) That have a rated pressure ratio greater than 30 but less than 62.5, and a maximum rated output greater than 89 kN:

Oxides of Nitrogen:  $(7 + 2(\text{rPR})) \text{ g/kN rO}$ .

(D) That have a rated pressure ratio greater than 30 but less than 62.5, and a maximum rated output greater than 26.7 kN but not greater than 89 kN:

Oxides of Nitrogen:  $(42.71 + 1.4286(\text{rPR}) - 0.4013(\text{rO}) + 0.00642(\text{rPR} \times \text{rO})) \text{ g/kN rO}$ .

(E) That have a rated pressure ratio of 62.5 or more:

Oxides of Nitrogen:  $(32 + 1.6(\text{rPR})) \text{ g/kN rO}$ .

(2) For Class TSS Engines manufactured on or after January 1, 1984:

Hydrocarbons:  $140 (0.92)^{\text{rPR}} \text{ g/kN rO}$ .

(e) Smoke exhaust emissions from each gas turbine engine of the classes specified below shall not exceed:

(1) For Class TF of rated output less than 26.7 kN (6,000 lb) manufactured on or after August 9, 1985:

$\text{SN} = 83.6(\text{rO})^{-0.274}$  (rO is in kN) not to exceed a maximum of  $\text{SN} = 50$ .

(2) For Classes T3, T8, TSS, and TF of rated output equal to or greater than 26.7 kN (6,000 lb) manufactured on or after January 1, 1984:

$\text{SN} = 83.6(\text{rO})^{-0.274}$  (rO is in kN) not to exceed a maximum of  $\text{SN} = 50$ .

(3) For Class TP of rated output equal to or greater than 1,000 kW manufactured on or after January 1, 1984:

$\text{SN} = 187(\text{rO})^{-0.168}$  (rO is in kW).

(f) The standards set forth in paragraphs (a), (b), (c), (d), and (e) of this section refer to a composite gaseous emission sample representing the operation cycles and exhaust smoke emission emitted during operation of the engine as specified in the applicable sections of subpart G of this part, and measured and calculated in accordance with the procedures set forth in subpart G.

(g) Where a gaseous emission standard is specified by a formula, calculate and round the standard to three significant figures or to the nearest 0.1 g/kN (for standards at or above 100 g/kN). Where a smoke standard is specified by a formula, calculate and round the standard to the nearest 0.1 SN. Engines comply with an applicable standard if the testing results show that the engine type certificate family's characteristic level does not exceed the numerical level of that standard, as described in § 34.60.

[Doc. No. 25613, 55 FR 32861, Aug. 10, 1990; 55 FR 37287, Sept. 10, 1990, as amended by Amdt. 34-3, 64 FR 5559, Feb. 3, 1999; Amdt. 34-4, 74 FR 19127, Apr. 28, 2009; Amdt. 34-5, 77 FR 76851, Dec. 31, 2012]

#### § 34.23 Exhaust Emission Standards for Engines Manufactured on and after July 18, 2012.

The standards of this section apply to aircraft engines manufactured on and after July 18, 2012, unless otherwise exempted or excepted. Where a gaseous emission standard is specified by a formula, calculate and round the standard to three significant figures or to the nearest 0.1 g/kN (for standards at or above 100 g/kN). Where a smoke standard is specified by a formula, calculate and round the standard to the nearest

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0.1 SN. Engines comply with an applicable standard if the testing results show that the engine type certificate family's characteristic level does not exceed the numerical level of that standard, as described in §34.60.

(a) Gaseous exhaust emissions from each new aircraft gas turbine engine shall not exceed:

(1) For Classes TF, T3 and T8 of rated output less than 26.7 kN (6,000 lb) manufactured on and after July 18, 2012:

$SN = 83.6(rO)^{-0.274}$  or 50.0, whichever is smaller

(2) Except as provided in §§34.9(b) and 34.21(c), for Classes TF, T3 and T8 engines manufactured on and after July 18, 2012, and for which the first individual production model was manufactured on or before December 31, 2013 (Tier 6):

## TIER 6 OXIDES OF NITROGEN EMISSION STANDARDS FOR SUBSONIC ENGINES

Class	Rated pressure ratio— rPR	Rated output rO (kN)	NO <sub>x</sub> (g/kN)
TF, T3, T8 .....	rPR ≤ 30 .....	26.7 < rO < 89.0 .....	38.5486 + 1.6823 (rPR) – 0.2453 (rO) – (0.00308 (rPR) (rO))
		rO > 89.0 .....	16.72 + 1.4080 (rPR)
	30 < rPR < 82.6 .....	26.7 < rO ≤ 89.0 .....	46.1600 + 1.4286 (rPR) – 0.5303 (rO) + (0.00642 (rPR) (rO))
		rO > 89.0 .....	– 1.04 + 2.0 (rPR)
	rPR ≥ 82.6 .....	All .....	32 + 1.6 (rPR)

(3) Engines exempted from paragraph (a)(2) of this section produced on or before December 31, 2016 must be labeled “EXEMPT NEW” in accordance with §45.13 of this chapter. No exemptions to

the requirements of paragraph (a)(2) of this section will be granted after December 31, 2016.

(4) For Class TSS Engines manufactured on and after July 18, 2012:

## GASEOUS EMISSION STANDARDS FOR SUPERSONIC ENGINES

Class	Rated output rO <sup>1</sup> (kN)	NO <sub>x</sub> (g/kN)	CO (g/kN)
TSS .....	All .....	36 + 2.42 (rPR) .....	4,550 (rPR) <sup>–1.03</sup>

<sup>1</sup> rO is the rated output with afterburning applied.

(b) Gaseous exhaust emissions from each new aircraft gas turbine engine shall not exceed:

(1) For Classes TF, T3 and T8 engines of a type or model of which the first in-

dividual production model was manufactured after December 31, 2013 (Tier 8):

## TIER 8 OXIDES OF NITROGEN EMISSION STANDARDS FOR SUBSONIC ENGINES

Class	Rated pressure ratio— rPR	Rated output rO (kN)	NO <sub>x</sub> (g/kN)
TF, T3, T8 .....	rPR ≤ 30 .....	26.7 < rO < 89.0 .....	40.052 + 1.5681 (rPR) – 0.3615 (rO) – (0.0018 (rPR) (rO))
		rO > 89.0 .....	7.88 + 1.4080 (rPR)
	30 < rPR < 104.7 .....	26.7 < rO < 89.0 .....	41.9435 + 1.505 (rPR) – 0.5823 (rO) + (0.005562 (rPR) (rO))
		rO > 89.0 .....	– 9.88 + 2.0 (rPR)
	rPR ≥ 104.7 .....	All .....	32 + 1.6 (rPR)

(c) Engines (including engines that are determined to be derivative engines for the purposes of emission certification) type certificated with characteristic levels at or below the NO<sub>x</sub> standards of § 34.21(d)(1)(vi) of this part (as applicable based on rated output and rated pressure ratio) and introduced before July 18, 2012, may be produced through December 31, 2012, without meeting the NO<sub>x</sub> standard of paragraph (a)(2) of this section.

[Doc. No. 34-5, 77 FR 76851, Dec. 31, 2012]

### Subpart D—Exhaust Emissions (In-use Aircraft Gas Turbine Engines)

#### § 34.30 Applicability.

The provisions of this subpart are applicable to all in-use aircraft gas turbine engines certificated for operation within the United States of the classes specified, beginning on the dates specified in § 34.31.

#### § 34.31 Standards for exhaust emissions.

(a) Exhaust emissions of smoke from each in-use aircraft gas turbine engine of Class T8, beginning February 1, 1974, shall not exceed a smoke number (SN) of 30.

(b) Exhaust emissions of smoke from each in-use aircraft gas turbine engine of Class TF and of rated output of 129 kN (29,000 lb) thrust or greater, beginning January 1, 1976, shall not exceed  $SN = 83.6(rO)^{-0.274}$  (rO is in kN).

(c) The standards set forth in paragraphs (a) and (b) of this section refer to exhaust smoke emission emitted during operation of the engine as specified in the applicable sections of subpart G of this part, and measured and calculated in accordance with the procedures set forth in subpart G.

[Doc. No. FAA-2012-1333, 77 FR 76852, Dec. 31, 2012]

### Subpart E—Certification Provisions

#### § 34.48 Derivative engines for emissions certification purposes.

(a) *General.* A derivative engine for emissions certification purposes is an engine configuration that is determined to be similar in design to a pre-

viously certificated (original) engine for purposes of compliance with exhaust emissions standards (gaseous and smoke). A type certificate holder may request from the FAA a determination that an engine configuration is considered a derivative engine for emissions certification purposes. To be considered a derivative engine for emission purposes under this part, the configuration must have been derived from the original engine that was certificated to the requirements of part 33 of this chapter and one of the following:

(1) The FAA has determined that a safety issue exists that requires an engine modification.

(2) Emissions from the derivative engines are determined to be similar. In general, this means the emissions must meet the criteria specified in paragraph (b) of this section. The FAA may amend the criteria of paragraph (b) in unusual circumstances, for individual cases, consistent with good engineering judgment.

(3) All of the regulated emissions from the derivative engine are lower than the original engine.

(b) *Emissions similarity.* (1) The type certificate holder must demonstrate that the proposed derivative engine model's emissions meet the applicable standards and differ from the original model's emission rates only within the following ranges:

- (i)  $\pm 3.0$  g/kN for NO<sub>x</sub>.
- (ii)  $\pm 1.0$  g/kN for HC.
- (iii)  $\pm 5.0$  g/kN for CO.
- (iv)  $\pm 2.0$  SN for smoke.

(2) If the characteristic level of the original certificated engine model (or any other sub-models within the emission type certificate family tested for certification) before modification is at or above 95% of the applicable standard for any pollutant, an applicant must measure the proposed derivative engine model's emissions for all pollutants to demonstrate that the derivative engine's resulting characteristic levels will not exceed the applicable emission standards. If the characteristic levels of the originally certificated engine model (and all other sub-models within the emission type certificate family tested for certification) are below 95%